Northern Counties Association
for the Blind

The Eye

A Paper read by

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¶ The attention of the reader is drawn to the diagram of a vertical section of the eye which appears at the end of the paper.

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The Eye.

HOME TEACHERS, I understand, find difficulty in recognising the names, given to them by the blind people they visit, of the various diseases of the Eye. I can sympathise with them in this, as I have experienced the same difficulty. The names of the diseases being derived from Latin and Grecian sources, are themselves difficult, but become much easier to remember if we know something about the structure of the eye, the names of its various parts and their functions. To-day, therefore, I propose to describe these to you and then to enumerate briefly the diseases which attack these various parts.

Those of you who are photographers will know something of the structure of a camera, and the method by which photographs are taken. The camera is modelled exactly on the eye, and the two are strictly comparable. In each we have a main chamber which, in the camera is painted inside with black paint, and in the eye is lined with black pigment. In both cases there is a clear central aperture in front through which light can pass. This aperture in the case of the eye is called the Pupil. The light can be shut off from the aperture, in the camera by a shutter, and in the eye by the eyelids. We can also regulate the amount of light that can enter by a movable diaphragm which in the eye is called the Iris and in the camera the Iris Diaphragm. In each case we have a lens to bring the object to a focus. The best cameras contain a compound lens and such is found in the eye. As objects which we wish to take or see are not always at the same distance from us we must have a focussing arrangement, which in the camera is carried out by increasing or decreasing the distance between the lens and the sensitive film, but in the eye is much more perfectly carried out by increasing the curvature of the lens and thus increasing its power. The object being thus correctly focussed, is then identified and recorded, in the camera on a sensitive plate, in the eye on a sensitive membrane at the back of the eye called the Retina. In Photography this plate must be developed and on it light shades are black, black shades are white and the image is reversed,—it is a negative ; it is then printed and the image becomes positive. In the eye the image received on the Retina is negative also, that is upside down and right and left are reversed. This image is conveyed to the brain which corrects this and makes the image positive again. The photographic plate is stored in a box, the retinal image is stored in the brain and we can visualise this image at any time by thinking about it.

The eye is more sensitive than the camera because it records colour as well as form and brightness and sharpness of image. Thus we have in the eye Colour Sense, Light Sense, and Acuteness of Vision.

Visual Acuity or Acuteness of Vision is the power which the eye has of distinguishing form. To measure this acuteness we must have a standard and that would be the smallest image which could be distinguished on the Retina. We cannot measure this but it is proportional to the visual angle which is 5 minutes. In **Snellen's test type,** which is generally used to test the Visual Acuity, all the letters make use of this angle at certain stated distances. On this type we have letters which should be seen by a normal eye at 60 metres, 36 metres, 24 metres, 18 metres, 12 metres, 9 metres, and 6 metres. (A metre is 40 inches, so that 6 metres is about 20 feet.)

A person who has normal sight should see the 6 metre letters when 6 metres distant from it and his vision is then $\frac{6}{6}$.

A person who is not quite normal cannot see the 6 metre letters at 20 feet, but if he can see the 9 metre letters his vision is $\frac{6}{9}$.

Similarly, if his vision is still worse and he can only see the 12 metre letters his vision is $\frac{6}{12}$.

If his vision is still worse he may only see the 18 metre letters or the 24 metre letters, or 36 metre letters, or the 60 metre letters, then his vision respectively is $\frac{6}{18}$, or $\frac{6}{24}$, or $\frac{6}{36}$, or $\frac{6}{60}$.

You will notice that the top 6 is repeated each time and it refers to the distance at which the test is taken (namely, six metres) whereas, the bottom figure refers to the letters which are read at that distance, in other words, if his vision is $\frac{6}{24}$ he can only see at 6 metres distance letters which he should read at 24 metres distance. Each eye is tested separately and it is quite possible, and, indeed, not uncommon to have considerable differences in the vision of the two eyes, *e.g.*, $\frac{6}{6}$ and $\frac{6}{24}$.

A vision of $\frac{6}{60}$ in each eye is the meeting point of blindness and non-blindness for the purposes of the Blind Persons Act, 1920.

I trust I have made this quite clear to you.

I now propose to describe to you the main points in the structure of the eye.

The Eyeball (or Globe) is globular in shape but slightly longer from front to back than from side to side.

1. It is covered in front by a membrane which also lines the inside of the lids, but this membrane does not pass over the central coloured part of the eye. It is called the Conjunctiva.

2. Where the Conjunctiva finishes at the central part of the eye in front there is a perfectly transparent circular area which when looked at from the side is seen to project forward in front of the rest of the eyeball; this is called the Cornea.

3. Immediately behind the Cornea is a shallow chamber filled with a watery fluid, this is called the Anterior Chamber of the eye.

4. The back wall of this Anterior chamber is formed by the Lens. The Lens is circular and convex on both surfaces; it is transparent and very elastic. The convexity of the lens can be increased for the purposes of focussing.

5. Immediately in front of the lens is a circular curtain with a central aperture or hole. The curtain is coloured blue, brown, grey, green or black, and is called the Iris; the aperture is called the Pupil, and it always looks dark. The Iris is freely movable, increasing or decreasing the size of the Pupil, and it is moved by a muscle which is called the Ciliary Muscle.

6. Behind the lens is the Posterior chamber of the eye and it forms the larger part of the eyeball or globe. It is filled with a clear jelly-like fluid called the Vitreous.

7. This posterior chamber is lined on its inner side by a thin delicate membrane (the sensitive plate of the camera) which is called the Retina.

8. The lens focusses images on this Retina which is really the spread out end of the Optic Nerve, which conveys the images thus received to the brain.

9. Outside the Retina lies the Choroid or Chorioid which is a membrane which carries the blood vessels of the eye and is deeply pigmented with black pigment.

10. Outside the Choroid lies a thick membrane or coat which is white in colour and very strong in order to protect the eye from injury. It can be seen as the "white of the eye," and it is called the Sclerotic.

I will now briefly enumerate the **diseases causing blindness,** dealing with them in relation to the various parts of the eye which I have described, and giving the same numbers as above.

1. CONJUNCTIVA. Any disease of this part is known as Conjunctivitis generally with another name in front giving the cause, *e.g.*, Catarrhal Conjunctivitis. Frequently these diseases are called Ophthalmia.

(*a*) **Ophthalmia Neonatorum** or **Gonorrhoeal Conjunctivitis** is due to an infection of the eye of the newly born babe at birth. It is an intense inflammation which spreads to the Cornea either destroying it or leaving a scar through which light cannot pass. This is a very frequent cause of blindness.

(*b*) **Trachoma,** common in Jews, Egyptians and South Western Irish, is due to a chronic affection of the Conjunctiva of the lids. It frequently causes Ulcers of the Cornea, which end in white scars and thus cause blindness.

(*c*) **Injuries,** such as burns by lime, hot fluids or fire, or cuts by sharp missiles cause blindness in a similar manner.

(*d*) **Malignant Tumours,** such as Sarcoma also cause blindness.

2. **CORNEA.** Inflammation of this part is called *Keratitis.*

(*a*) **Interstital Keratitis** due to Syphilis is a common cause of blindness.

(*b*) **Corneal Ulcers** or **Ulcerative Keratitis** are due to various infections and cause blindness due to the scars they leave. They frequently also arise from injury and may perforate the Cornea which is sometimes followed by a condition called

(*c*) **Staphyloma of the Cornea or Conical Cornea.**

The scars left on the Cornea are white and dense and do not admit light. They are frequently called " Pearls " or " Cataracts " by people, but their real names are Nebulae Corneae or Leucoma Corneae according to the size of the scars.

4. **LENS.** If the clear crystalline lens become opaque and white due to any cause this is the condition known as Cataract. The two common forms are :—

(*a*) **Congenital Cataract** found in babies, it sometimes causes blindness but can usually be cured by an operation.

(*b*) **Senile Cataract** occurs in older people or as the result of disease such as Diabetes. It causes blindness but the lens can be removed and a fair restoration of sight be attained. If the eye be infected at the operation, the eye is lost, as it becomes disorganised and the eye shrinks, which is a condition called *Phthisis Bulbae.*

(*c*) Injury to the lens may cause Cataract or the lens may be dislocated. The latter causes considerable loss of sight.

5. IRIS AND CILIARY BODY. Inflammation of the Iris is called *Iritis* and that of the Ciliary Body *Cyclitis.* It is common for the inflammation to spread from one to the other, and we then get the condition called *Irido-Cyclitis.*

(*a*) **Inflammations** (*e.g., Iritis or Irido-Cyclitis*) of this part of the eye are caused by :—

Tuberculosis.
Rheumatism.
or Syphilis.

They cause loss of vision by causing limitation of the movements of the pupil. The pupil may be completely closed, with complete loss of sight, a condition known as *Occlusion of the Pupil.*

(*b*) **Glaucoma** is a frequent cause of blindness in older people, it is caused by increased pressure or tension in the eye. It follows on an inflammation of the Ciliary Body or may occur suddenly without warning.

(*c*) **Sympathetic Ophthalmia** is an infection of the Ciliary Body following on an injury to the other eye, it may be years afterwards. It nearly always causes blindness. *Phthisis Bulbae* may follow any inflammation in this region.

6. VITREOUS. Haemorrhage into this due to a blow may cause blindness.

7. RETINA.

(*a*) **Inflammation** of this is called *Retinitis* and we usually get a prefixed name which gives the cause of the inflammation, *e.g.*, *Syphilitic*, *Diabetic*, *Albuminuric Retinitis*, due respectively to Syphilis, Diabetes, or Kidney Disease.

(*b*) **Haemorrhage** into the Retina may occur or the blood vessels may be blocked by blood clot and so we get *Embolism* or *Thrombosis of the Retina.*

(*c*) **Tumours** occur here also, *e.g.*, *Sarcoma of the Retina.*

(*d*) **Detachment of the Retina** where it becomes separated causes blindness; it occurs in people with high Myopia or due to injury.

(*e*) **Albinism** in albinos causes great loss of sight.

8. OPTIC NERVE. Inflammations of this are called :—

(*a*) **Optic Neuritis.** There are various causes for this—Tumour of the Brain, Lead Poisoning, Arsenical Poisoning, Meningitis, Syphilis, etc.

Optic Neuritis leads to degeneration of the nerve and it is then called :—

(*b*) **Optic Atrophy,** and the eye becomes quite blind.

(*c*) **Tumours of the Optic Nerve** occur or it may be injured and cause great loss of sight.

(*d*) **Hereditary Optic Neuritis and Atrophy** is found in families. It is passed on by parents to their children and this may go on for generations. It does not always cause blindness but very frequently does.

9. CHOROID. Inflammation of this is called *Choroiditis,* frequently it is due to Syphilis, but there are other causes. It causes loss of sight, and when extensive, blindness.

There are certain **congenital conditions** of the eye causing blindness :—

1.	**Microphthalmos.**	In this the child is born with a very small eyeball. Both eyes are generally affected and the smaller the eye the less the sight.
2.	**Buphthalmos.**	Here the eye is very large, there is increased pressure in the eye and blindness is generally the result.
3.	**Colombo of the Choroid.**	Here the Choroid coat is deficient and it causes loss of sight or even blindness if the deficiency is extensive.
4.	**Congenital Amaurotic Idiocy.**	Another condition found in Jews, when blindness is present as well as mental deficiency.

Before closing I should like to touch upon the question of defective vision due to what is called **Errors of Refraction.**

In the normal eye rays of light coming from a distance should focus on the Retina. Where, however, the eye is too long from back to front, we get the condition called *Myopia* (or short sight). Where the eye is too short we get the condition called *Hypermetropia* (or long sight).

Hypermetropia may cause loss of sight but never blindness.

In Myopia we get serious loss of sight for distance, unless corrected by glasses, and it has an unfortunate tendency to increase in amount. Frequently, the eyeball is weakened at the back in Myopia, and this causes the Myopia to progress and we get the condition called *Progressive Myopia.* It causes blindness either due to its extent or by Detachment of the Retina.

The eyes are moved by muscles and we can get a want of balance in these which causes one eye to squint. The squinting eye is frequently blind due to disuse.

A person who is blind in one eye is not blind within the Act where the other eye is reasonably good, but such a person is unable to judge distance accurately because he has not got binocular vision.

I hope I have managed to cover all the ground, and to shed a little light on those difficulties which you, as Home Teachers to the Blind, have found in deciphering the various causes of their blindness given to you by the people whom you visit.

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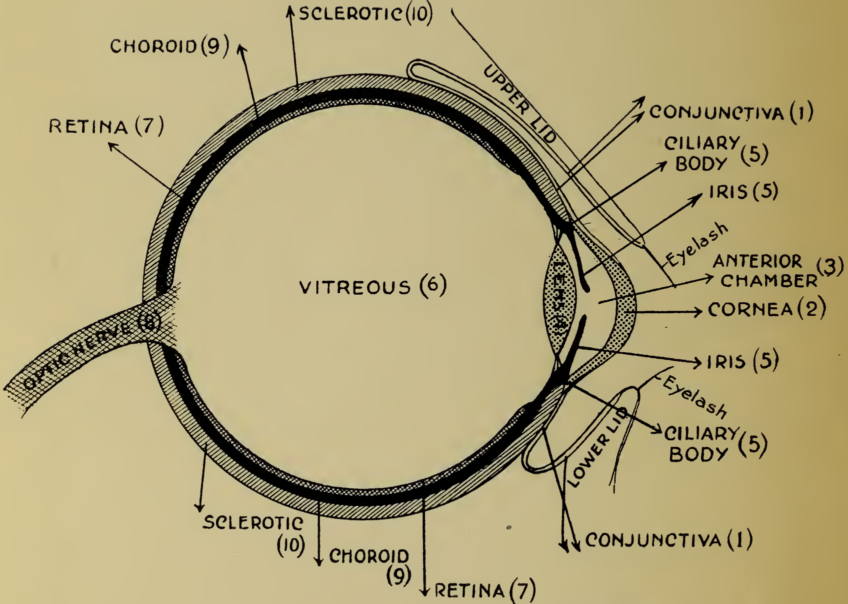
SCLEROTIC (10)
CHOROID (9)
RETINA (7)
UPPER LID
CONJUNCTIVA (1)
CILIARY BODY (5)
IRIS (5)
Eyelash
ANTERIOR CHAMBER (3)
VITREOUS (6)
LENS (4)
CORNEA (2)
OPTIC NERVE (8)
IRIS (5)
Eyelash
CILIARY BODY (5)
LOWER LID
SCLEROTIC (10)
CHOROID (9)
RETINA (7)
CONJUNCTIVA (1)